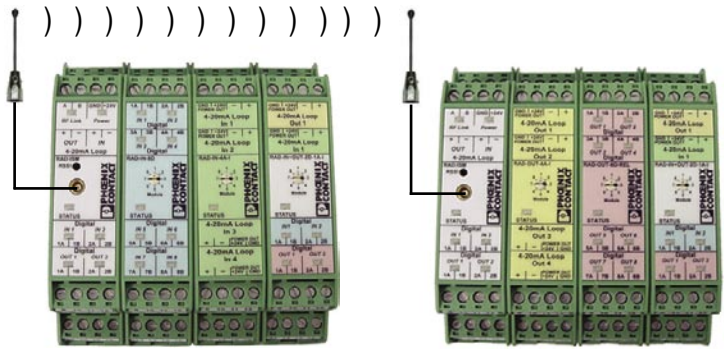
Wireless Interface RAD-ISM-900-SET-BD-BUS

Two-way (point-to-point) Monitoring and Control
with Expandable I/O Options
User Manual



Notice: These devices must be wired in accordance with Class I, Div. 2 wiring methods as described in the National Electrical Code, Article 501-4(b) or the authority having jurisdiction.

Transmitter unit is to be used with a purely resistive antenna when installed in Class I, Division 2 areas.

- Modular DIN-rail mount transceiver and I/O
- No programming required
- Maximum thirty-three (33) analog or sixty-six (66) digital signals in one direction
- Class I Div 2 approved
- Dry contact RF LINK diagnostics output
- Up to eight (8) expandable I/O modules (passive/active inputs and outputs) per transceiver on common power and communications bus with multiple combinations

The Phoenix Contact RAD-ISM-900-BD-BUS is an integrated radio & I/O module designed for bidirectional interfacing of a 4-20mA current loop and two discrete signals in harsh industrial environments. This unique design also allows the user the flexibility to add on multiple channels of I/O to the paired transceivers in combinations. The Frequency Hopping Spread Spectrum (FHSS) utilizes the 902-928MHz ISM band to guarantee a license free, interference free link between remote devices and the control room. The design is ideal for moving numerous signals within high interference environments without costly cable and conduit runs.

WARNING: EXPLOSION HAZARD
Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

FCC Rules and Compliance
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by Phoenix Contact Inc. will void the user's authority to operate the equipment.

This product is intended for fixed installation applications. In order to comply with FCC/ISC adopted RF exposure requirements, installation of this transmitter system's antenna must be performed in a manner that will provide at least a 6 foot (2m) clearance from the front radiating aperture to any user or member of the public.

FCC	Part 15.247
ISC	RSS 210
UL	Class I, Division 2 (Groups A,B,C,D)

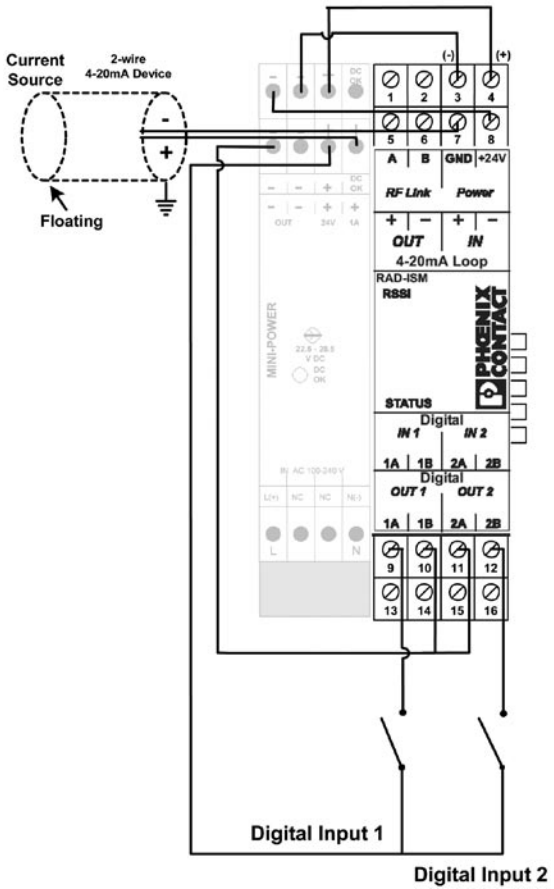


Figure 1:Two-Wire device 4-20mA current loop

RAD-ISM-900-BD-BUS Transceiver
Analog and Digital *INPUTS*

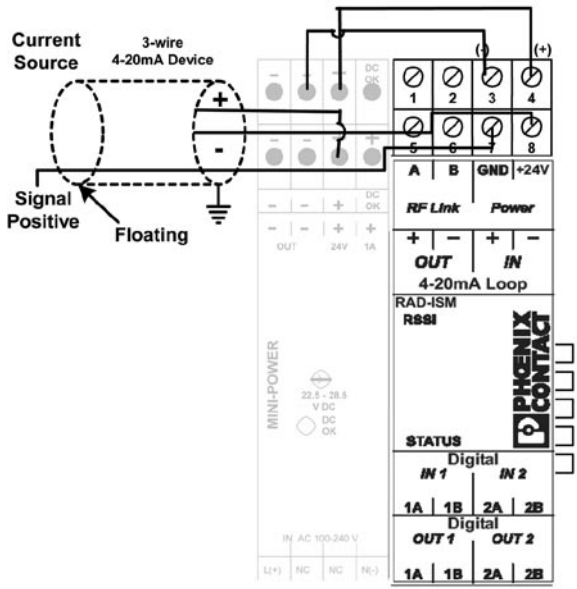


Figure 2:Three-Wire device 4-20mA current loop

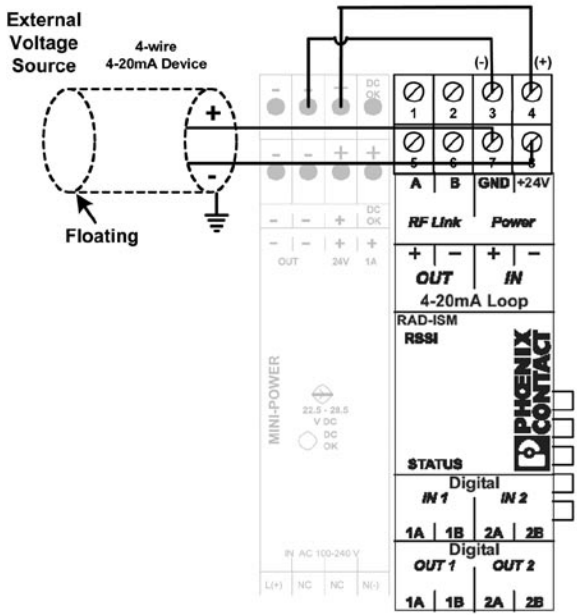


Figure 3: Four-Wire device 4-20mA current loop

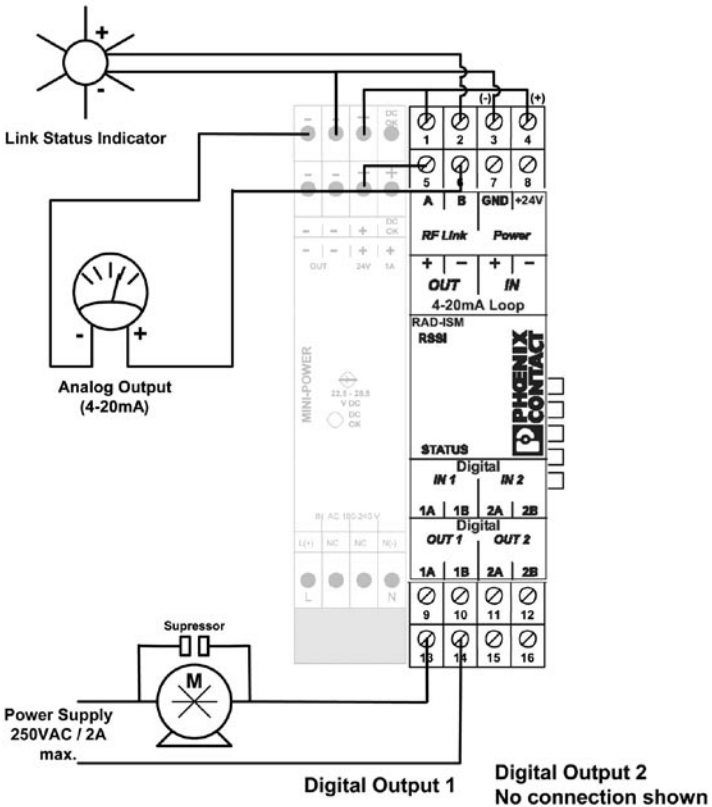


Figure 4: Output Examples

RAD-ISM-900-BD-BUS Transceiver

RF Link and Choosing Output States

RF Link Output

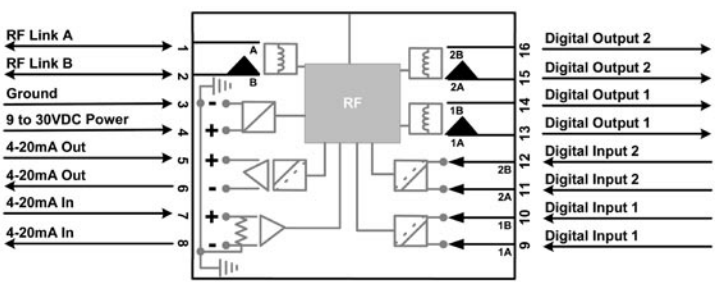
The Link Status contact on the RAD-ISM-900-BD-BUS is Normally Open (NO) and closes when the radio establishes an RF Link. It can be used to switch either a STATUS light or a FAULT indicator.

Selecting State of Outputs Upon Loss of RF Link

The default state upon loss of RF signal for the analog and digital outputs is MAINTAIN LAST STATE. They may be wired in series with the RF Link contact to provide a FAULT OFF when RF Link is terminated.

RAD-ISM-900-BD-BUS Transceiver

Block Diagram



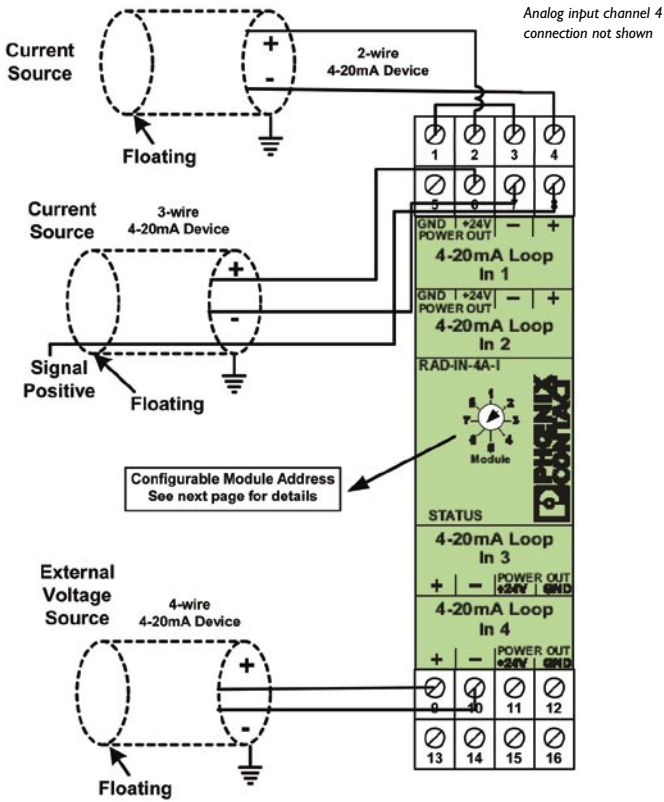
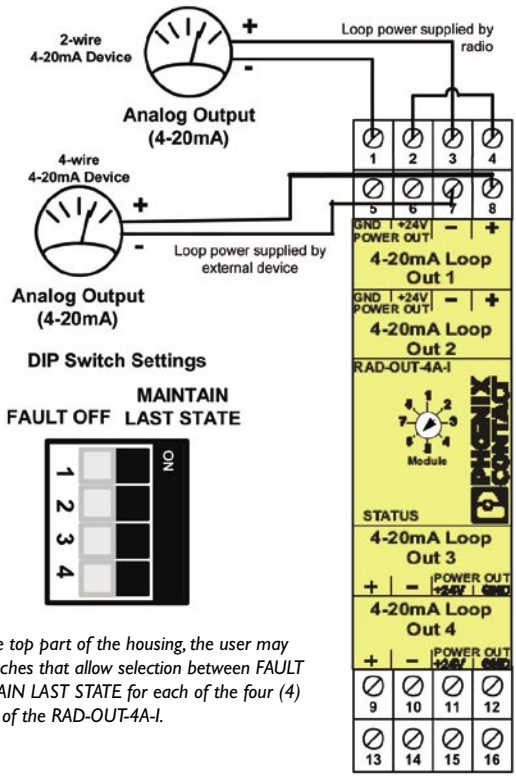


Figure 5: RAD-IN-4A-I (Analog Input)



Analog output channels 3 and 4 connections not shown

By releasing the top part of the housing, the user may access DIP switches that allow selection between FAULT OFF or MAINTAIN LAST STATE for each of the four (4) analog outputs of the RAD-OUT-4A-I.

Figure 6: RAD-OUT-4A-I (Analog Output)

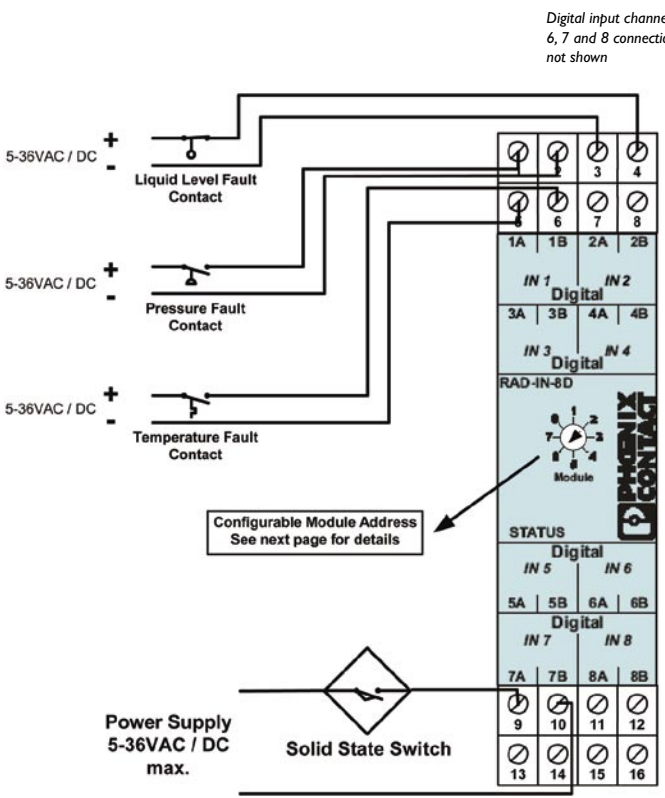
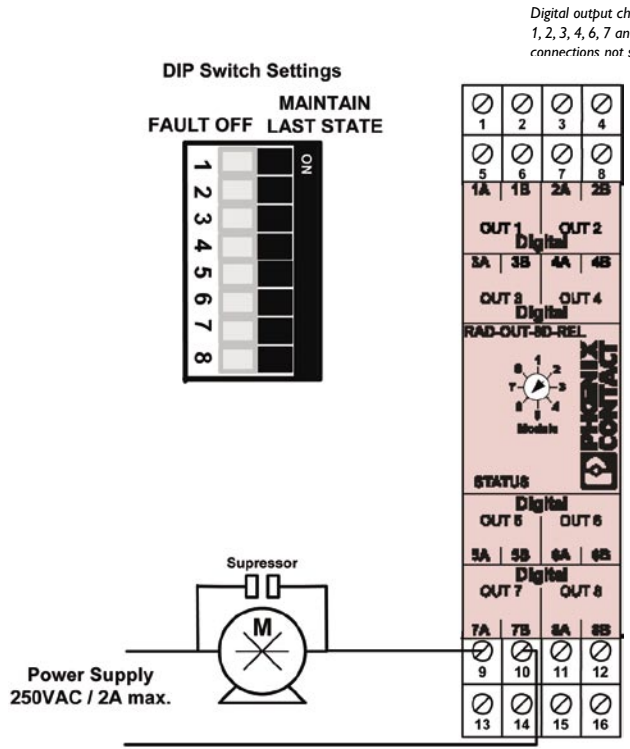


Figure 7: RAD-IN-8D (Digital Input)



By releasing the top part of the housing, the user may access DIP switches that allow selection between FAULT OFF or MAINTAIN LAST STATE for each of the eight (8) digital outputs of the RAD-OUT-8D-REL.

Figure 9: RAD-OUT-8D-REL (Digital Output)

RAD-ISM-900-BD-BUS Transceiver
Digital/Analog Input/Output

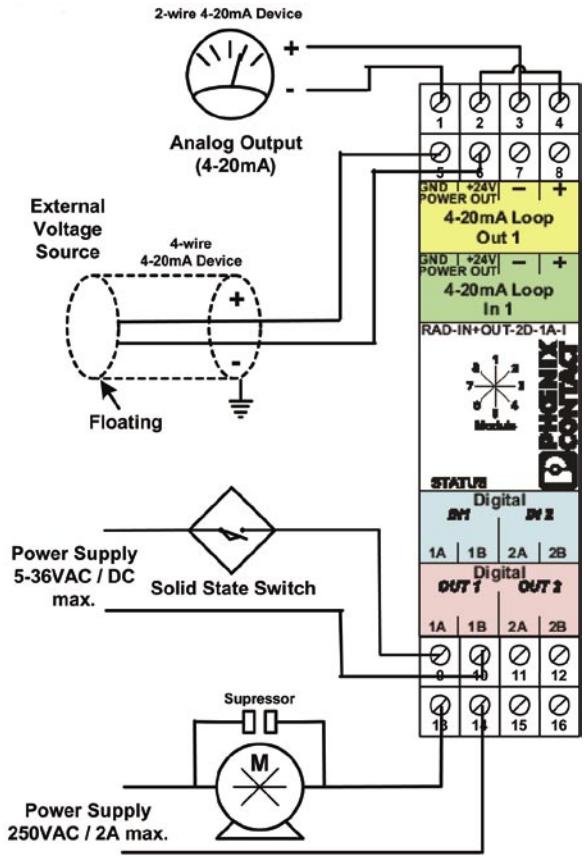


Figure 10: RAD-IN+OUT-2D-1A-I

Each pair of I/O modules, such as the RAD-IN-4A-I and the RAD-OUT-4A-I, must share a unique module address. Once a module address has been assigned to a pair of I/O modules, that module address may not be used on any other pair of I/O modules on the same radio pair. Available addresses are numbers 1 through 8. If module addresses conflict, or are improperly set within a connected group, an indication will be given by the STATUS LED (see section below).

The RAD-ISM-900-BD-BUS Transceivers are designed to operate as matched pairs and are factory programmed. Manual address configuration is not required for the transceiver units.

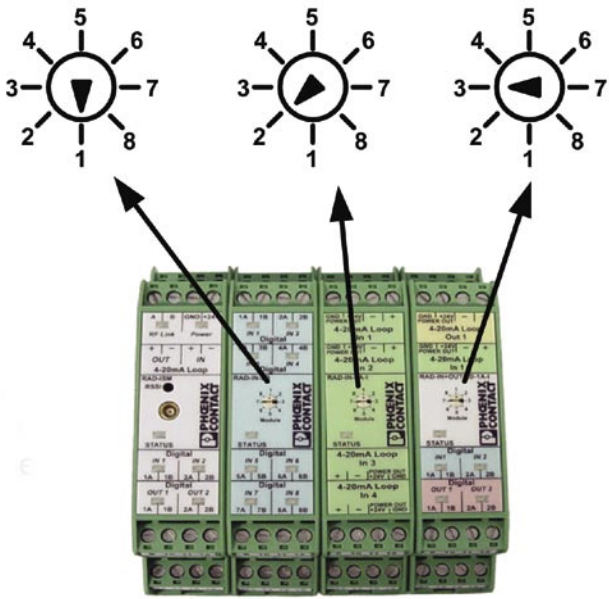


Figure 11: Module Address Selection Switch

RAD-ISM-900-BD-BUS Transceiver

Power Budget Requirements

The following table may be used as a reference when determining your power supply requirements. Total power requirements are shown per module, per side of the system. For example, the transmitter side may have one (1) transceiver, one (1) RAD-IN-4A-I expansion module and one (1) RAD-IN-8D expansion module. The total power requirement for this side of the system would be 213mA [75mA + 26 mA + 32 mA + (4 x 20 mA)].

The matching receiver side would have one (1) transceiver, one (1) RAD-OUT-4A-I expansion module and one (1) RAD-OUT-8D-REL expansion module. The total power requirement for this side of the system would be 287 mA [75 mA + 100 mA + 32 mA + (4 x 20 mA)].

*(Assuming internal bus power is used for analog I/O****)*

*Table 1: RAD-ISM-900-BD-BUS Rail Builder Power Budget Worksheet**

	Quantity X Power Requirement (in mA) = Total Power Consumption (in mA)		
Transceiver**	1	75 ***	75
Digital Input Expansion Module	8 max.	26	208
Digital Output Expansion Module	8 max.	100	800
Analog Input Expansion Module	8 max.	32	256
Analog Output Expansion Module	8 max.	32	256
Analog I/O Using Internal Power ****	8 max.	20	660
Total Power Supply Requirement (Sum of all devices used)			

* *These currents are 24 VDC.*

** *Allow for 200 mA peak on the transceiver*

*** *75 mA (average), 200 mA (peak)*

**** *If you are using internal power for the analog 4-20 mA current loops, then you will need to add 20 mA for each input and output being using in this fashion.*

RAD-ISM-900-BD-BUS Transceiver

Status LEDs

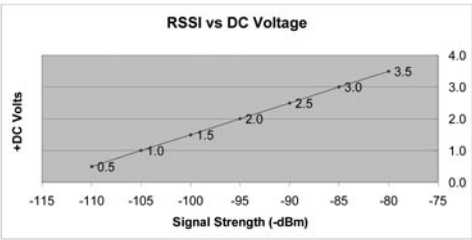
Power LED	Indicates presence of power to the device. It is ON when power is present and OFF when there is no power.
Status LED	When flashing rapidly, it indicates an internal error or a module type mismatch. A module type mismatch occurs when the module address selection for two different modules (i.e. one (1) digital module and one (1) analog module are set to the same address or two (2) pairs of modules are sharing the same address).
RF LED	• Flashes once every two seconds when there is no RF Link • Flashes rapidly when signal strength is marginal (see RSSI graph below) • ON steady indicates an exceptionally strong RF Link • Most systems will flash occasionally indicating the presence of intermittent interference in the area.
Digital Input/Output	OFF means that the digital input or output is Open ON means that the digital input or output is Closed

RAD-ISM-900-BD-BUS Transceiver

RSSI Troubleshooting

RSSI (Received Signal Strength Indicator) is measured using a DC Voltmeter between the test point and power supply ground. The test point is accessed by inserting a positive meter probe into the RSSI hole on the face of the RAD-ISM-900-BD-BUS and the negative meter probe to the Ground terminal.

The RSSI graph below may be used to test the Receive Signal Strength of the RAD-ISM-900-BD-BUS. The ideal voltage that should be read from the RSSI test point is 2.5VDC or more. This represents a 90dB signal loss and typically indicates that the radio has 20dB fade margin left until loss of link. It is recommended that the radios be set up with no less than 20dB margin.



RAD-ISM-900-BD-BUS Transceiver
Typical Components for a RAD-ISM-BD-BUS Remote Site

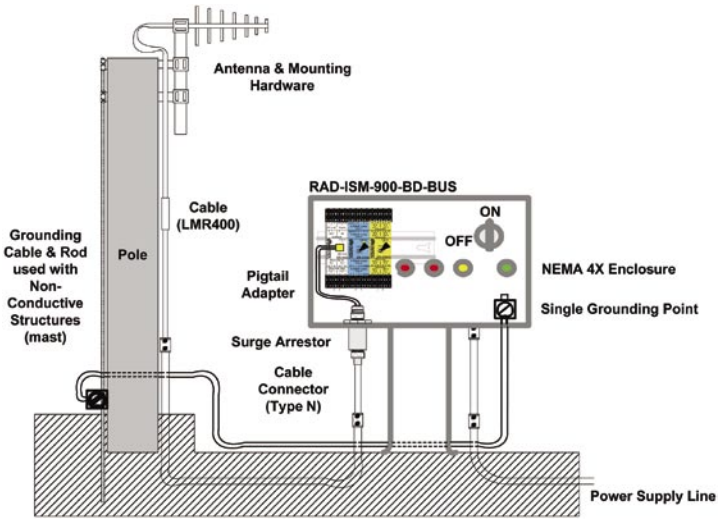


Figure 12: Components for RAD-ISM-900-BD-BUS Remote Site

RAD-ISM-900-BD-BUS Transceiver
Ordering Information

Part Description	Part No.
RAD-ISM-900-SET-BD-BUS-ANT (2-way transceiver with quarter-wave whip antennas)	28 67 27 0
RAD-ISM-900-SET-BD-BUS (2-way transceiver without antennas)	28 67 08 9
RAD-IN-4A-I (4-channel analog input module)	28 67 11 5
RAD-OUT-4A-I (4-channel isolated analog output module)	28 67 12 8
RAD-IN-8D (8-channel digital input module)	28 67 14 4
RAD-OUT-8D-REL (8-channel digital output with relays)	28 67 15 7
RAD-IN+OUT-2D-1A-I (2 digital / 1 analog input/output module)	28 67 32 2
RAD-ISM-900-BD-BUS (can be used as spare or repeater; requires ID no. of transceivers)	28 67 09 2
RAD-ISM-900-SET-UD-BUS (1-way system with 1 transmitter and 1 receiver only)	28 67 56 8
RAD-ISM-900-1TX-2RX-BUS (1-way system with1 transmitter and 2 receivers (expandable))	28 67 57 1
RAD-ISM-900-HOP-US (used to configure repeater(s) or replacement transceivers)	28 67 53 9
RAD-ISM-900-ANT-4 (4-way splitter to cascade receivers in simplex mode)	28 67 05 0

RAD-ISM-900-BD-BUS Transceiver
Ordering Information

Accessories

Item	Part Description	Part No.
Antennas	RAD-ISM-900-ANT-OMNI-0-6 (¼ wave Omni antenna with 6 feet of cable & MCX (M) connector)	28 67 16 0
	RAD-ISM-900-ANT-OMNI-5 (5dB Omni base station, Larsen FB35 T900, full ground plain with type N(F) connector)	28 67 19 9
	RAD-ISM-900-ANT-YAGI-6 (6dB Yagi, Larsen 3 element with type N (F) connector)	28 67 20 9
Cables	RAD-CAB-RG213-50 (RG2130 - 50 feet with type N (M) connectors) - cable loss = 7.6dB/100 feet	28 67 22 5
	RAD-CAB-LMR400-100 (LMR400 - 100 feet with EZ400 NMH type N (M) connectors) - cable loss = 3.9db/100 feet	28 67 23 8
	RAD-CAB-RG58-10 (RG58 - 10 feet with type N (M) connectors) - cable loss = 16dB/100 feet	28 67 36 4
Adapters	RAD-CON -N-BNC-BS (N (F) to BNC (F) adapter)	28 67 24 1
	RAD-CON-MCX-N-SS (MCX (M) to N (M) fitting with 48" of RG316 cable)	26 27 25 4
	RAD-CON-MCX-BNC-SB (MCX (M) to BNC (F) with 24" of RG174AU cable)	28 67 26 7
	RAD-CON-SMA-N-SS (SMA (M) to N (M) with 48" of RG316 cable)	28 67 40 3
	RAD-CON-SMA-BNC-SB (SMA (M) to BNC (F) with 2' of RG174 cable)	28 67 72 0
Surge Arrestor	CN-UB-280DC-BB (bulkhead mount COAXTRAB)	56 03 85 9

Other types and variations of accessories are available. Please contact your local distributor or Phoenix Contact Inc. for more information.

RAD-ISM-900-BD-BUS Transceiver
Specifications

Table 2: RAD-ISM-900-BD-BUS (p/n 28 67 27 0)

General	
Range	600 to 1,000 feet (180 to 305 m) in-plant (obstructed); 4-5 miles (6-8 km) LOS with Omni antenna; 20+ miles (32+ km) LOS with Yagi antenna
Inputs	One (1) 4-20 mA analog input (16-bit, 125 ohms impedence) Two (2) digital inputs (5-30 VDC)
Outputs	One (1) 4-20 mA analog input (16-bit, short-circuit protected) Two (2) digital inputs (dry contact, NO, contact rating: 250 VAC/2 A)
I/O Expansion Capacity	Four (4) analog and eight (8) digital I/O modules
Repeatability	Current loop: 0.02%
Accuracy	Current loop: 0.2% of full scale at 77°F (25°C)
Wiring Connections	12-24 AWG screw-type terminals; removable terminal blocks
Mounting	DIN-rail mount
Primary Power	
Input Voltage	9 to 30 VDC
Reverse Polarity Protection	Yes
Surge Protection	Yes
Power Consumption	75mA (avg)/200mA (peak) @ 24VDC during transmission (plus I/O modules)
Transceiver	
Frequency	902 to 928 MHz - ISM band
Transmit Power	1 Watt (30 dBm)
RX Sensitivity	-110dBm
Unit ID	Factory configured (unique); 16-bit coding of each transceiver pair allows multiple units to be used in the same area
Antenna Connector	MCX female
Antenna Impedence	50 ohms

RAD-ISM-900-BD-BUS Transceiver
Specifications

Diagnostics	
Indicators	External LEDs (power, RF link, I/O status)/RF link relay 250 VAC / 2 A
Environmental	
Humidity	20% to 90% (non-condensing)
Temperature	Operating: -40° to +158°F (-40° to +70°C)
Size	4.5" x 3.9" x 0.9" (114 mm x 99 mm x 23 mm)
Weight	5.3 oz (150 g)
Enclosure	NEMA 1 (equivalent to IP20)
Agency Approvals	
FCC	Part 15.247
ISC	RSS 210
UL/C	Class I, Div. 2 (Groups A, B, C, D)

Table 3: RAD-IN-8D Digital Input Module - Low Volt (p/n 28 67 14 4)

Channels	Eight (8)
Input Voltage Range	5 to 30 VAC/DC
Input Impedence	20 K ohms
Channel Isolation	Optical
Reverse Polarity Protection	Yes
Over-voltage Rating	100 VAC/DC max.
Power Consumption	30 mA max.

Table 4: RAD-OUT-8D-REL Digital Output Module - 8-ch Relay (p/n 28 67 15 7)

Channels	Eight (8)
Output Terminals	Dry contact (NO)
Contact Ratings	250 VAC / 2 A
Channel Isolation	Full
Power Consumption	160 mA max.

Table 5: RAD-IN-4A-I 4-20 mA Analog Input Module - 4-ch (p/n 28 67 11 5)

Channels	Four (4)
Resolution	16-bit
Input Impedence	< 170 ohms
Channel Isolation	None (power supply connections are common with tranceivers)
Reverse Polarity Protection	Yes
Compatability	2-wire, 3-wire, 4-wire devices
Over-voltage Rating	42 VDC max.
Accuracy	0.2% of full scale
Repeatability	0.02% of full scale
Power Consumption	130 mA max.

Table 6: RAD-OUT-4A-I 4-20 mA Analog Output Module - 4-ch ISOL (p/n 28 67 12 8)

Channels	Four (4)
Resolution	16-bit
Channel Isolation	Optical
Short-circuit Protection	Yes
Compatability	2-wire, 3-wire, 4-wire devices
Accuracy	0.12% of full scale
Repeatability	0.02% of full scale
Power Consumption	130 mA max.
Min. Loop Voltage Drop	10 V

Table 7: RAD-IN+OUT-2D-1A-I Input/Output Module (p/n 28 67 32 2)

Channels	One (1) analog input One (1) analog output Two (2) digital inputs Two (2) digital outputs
Channel Isolation	All (except for analog input channel)
Reverse Polarity Protection	Yes
Analog Channel Input Impedence	< 170 ohms
Analog Channel Repeatability	0.02% of full scale
Analog Channel Resolution	16-bit
Analog Channel Accuracy	0.2% of full scale
Analog Channel Compatability	2-wire, 3-wire, 4-wire devices
Analog Input Channel Over-voltage Rating	42 VDC max,
Digital Input Channel Input Impedence	20 K ohms
Digital Input Channel Over-voltage Rating	100 VAC/DC max.
Digital Input Channel Voltage	5 to 30 VAC/DC
Digital Output Channel Contact Ratings	250 VAC / 2 A
Digital Output Channel Type	Dry contact (NO)
Power Consumption	120 mA max.

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